Diel Habitat Selection by Juvenile Chinook Salmon in the Cedar River, Washington

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Within the Lake Washington basin, an important, wild run of chinook salmon occurs in the Cedar River. Juvenile chinook salmon are present in the Cedar River from January to July; however, little is known about their habitat requirements. We studied the diel habitat use and preference of these fish. Results from this study will aid resource managers in determining proper protection and restoration efforts for chinook salmon. We characterized habitat selection using a five level hierarchical habitat classification system. Level one described the channel type as main, side-channel, braided channel, tributary mouth, or slough. Classification at levels two through four was based on the habitat characteristics of the entire channel width. Level 5 was used to characterize small distinct secondary habitats within the larger habitat. Habitat was classified as deep or shallow water in level two. Deep and shallow water was further classified as scour or dammed pool (deep water); or turbulent or non-turbulent, respectively in level three. Levels four and five classified the habitat by the type of pool (lateral scour, eddy, etc.) or riffle (riffle, rapid, cascade, etc.). Habitat selection did not vary consistently diurnally or seasonally. Juvenile chinook salmon used off channel habitats such as slough and side channels extensively and preferred these habitats to main channel habitats. Juvenile chinook salmon in the main channel preferred secondary habitats associated with the bank, especially eddies. Future analyses will include an evaluation of the influence of other variables, such as velocity, depth, substrate, and cover on juvenile chinook salmon densities.

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Objectives

- **Determine diel habitat selectivity by juvenile chinook salmon**
- **Identify important main channel and lateral habitat rearing areas**
- **Determine temporal changes in habitat use**

Snorkeling along a logjam.

Methods

- Snorkel estimates made using bounded count
  - Abundance = 2*(high count) – low count
- Two reaches surveyed once a month
- Ten additional reaches surveyed once
- Habitat classified using a 5 level modified hierarchical habitat classification system (Hawkins et al. 1993)

Habitat

- **Level 1 – Channel Type**
  - **Main, Braided, Side, Overflow, Slough, Tributary mouth**
- **Levels 2-4 – Classify the entire channel width**
- **Level 5 – Classifies secondary channel units >20% of channel width long or wide**


Level 1 classifications
Level 1 – Channel Type
Main Channel
Braided Channel
Side Channel
Overflow Channel
Slough
Tributary mouth
Main
Slough


Example of main channel and braided channel
Main Channel
Braided Channel

Levels 2 & 3

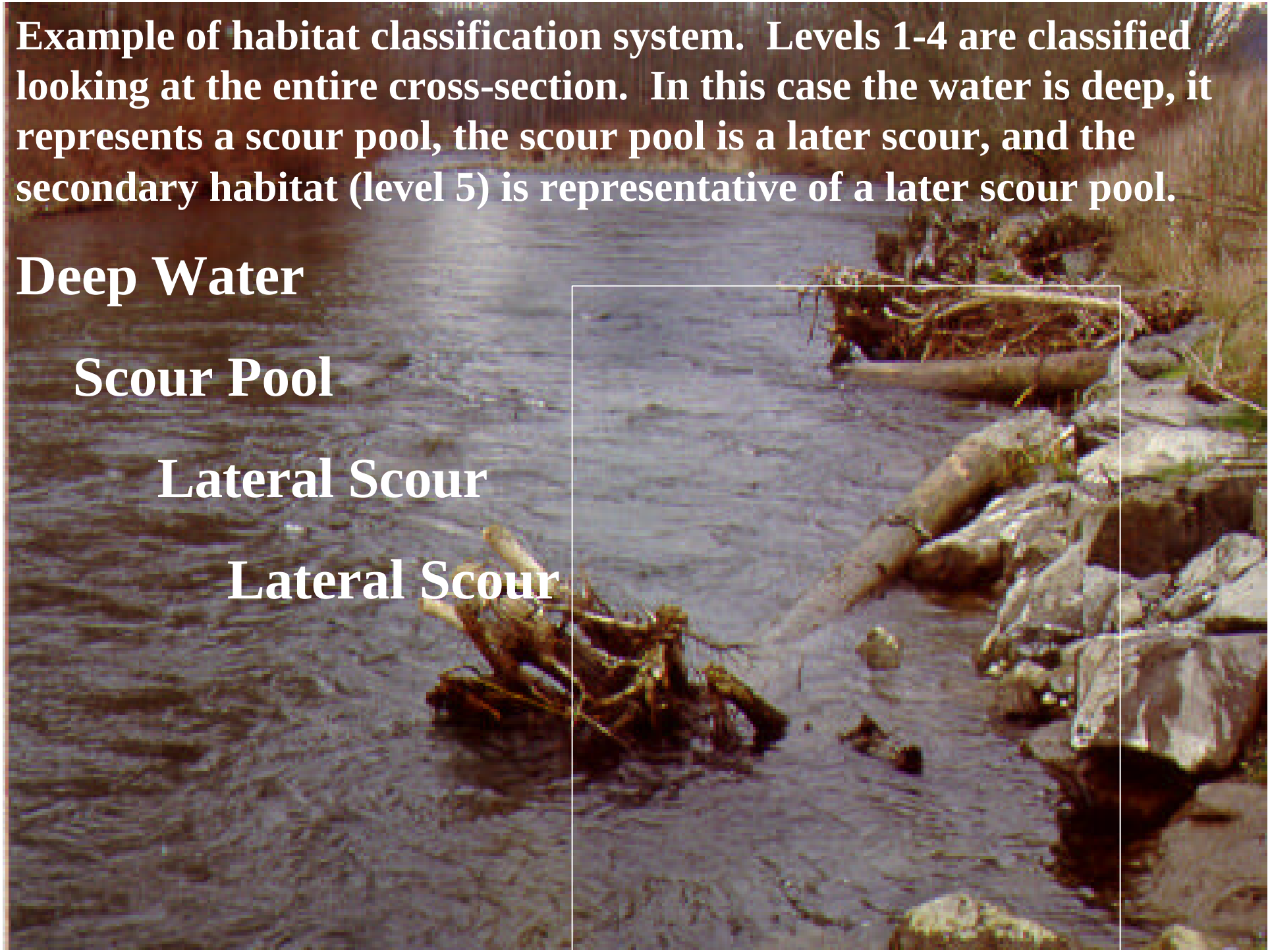
- **Deep Water**
  - **Scour Pool**
  - **Dammed Pool**
- **Shallow Water**
  - **Turbulent**
  - **Non-Turbulent**

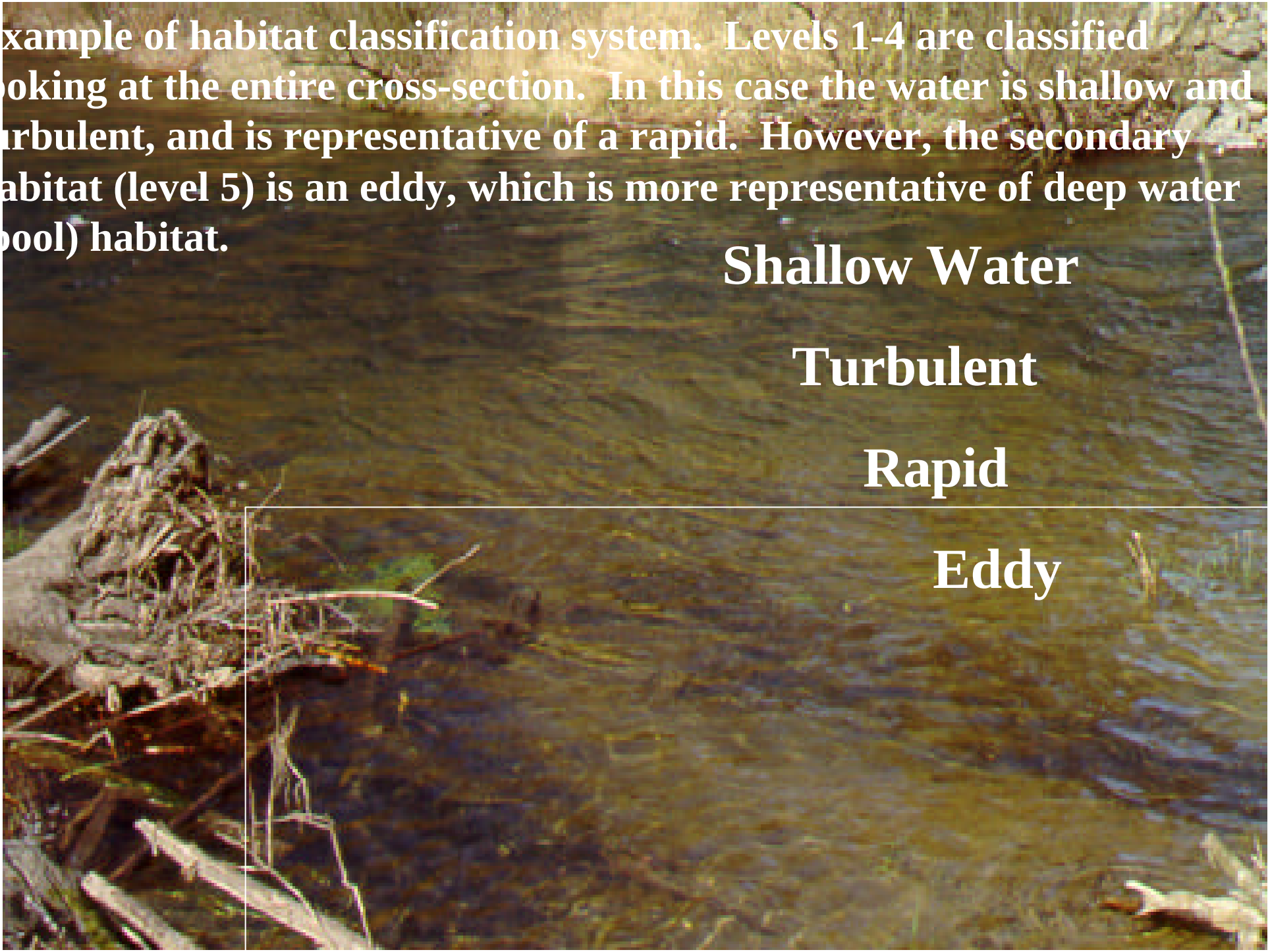
Levels 4 & 5

- **Scour Pool**
  - **Eddy**
  - **Trench**
  - **Mid Channel**
  - **Convergence**
  - **Lateral**
  - **Plunge**
  - **Deposition**
- **Dammed Pool**
  - **Debris**
  - **Beaver**
  - **Landslide**
  - **Backwater**
  - **Abandoned Channel**

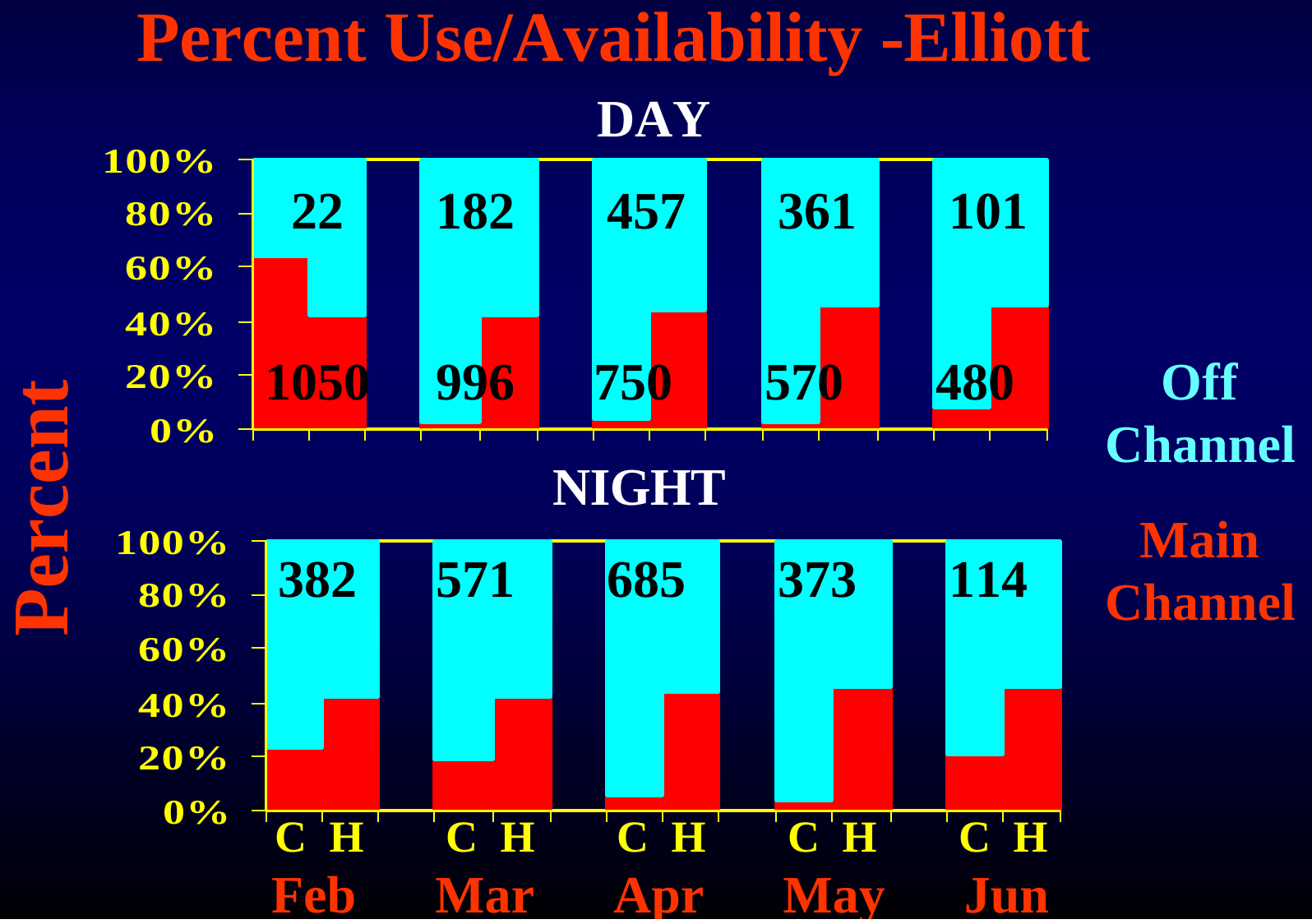
Levels 4 & 5

- **Turbulent**
  - **Riffle**
  - **Rapid**
  - **Chute**
  - **Fall**
  - **Cascade**
- **Non-turbulent**
  - **Sheet**
  - **Run**
  - **Tail out**

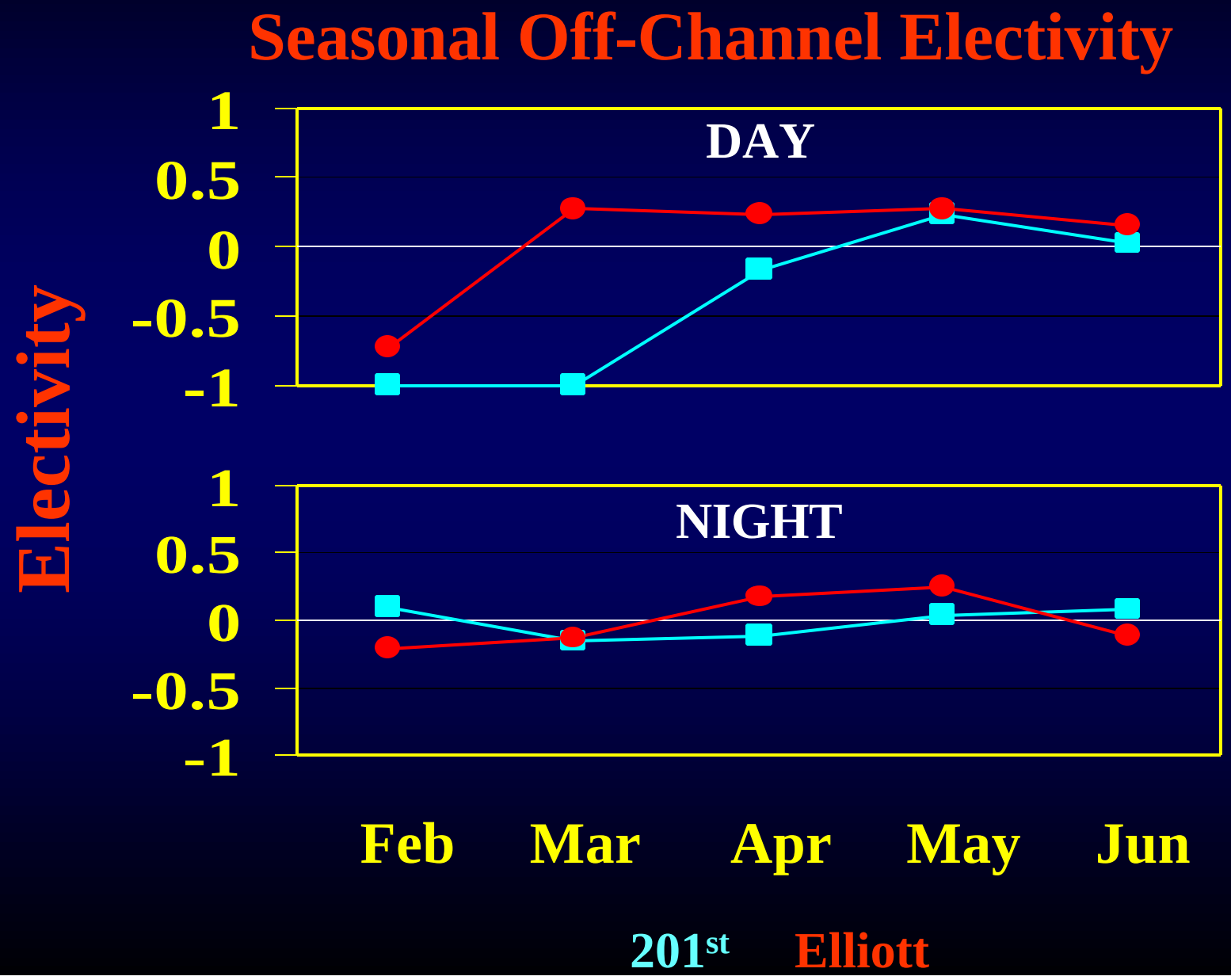

Example of habitat classification system. Levels 1-4 are classified looking at the entire cross-section. In this case the water is deep, it represents a scour pool, the scour pool is a later scour, and the secondary habitat (level 5) is representative of a later scour pool.
Deep Water
Scour Pool
Lateral Scour
Lateral Scour


xample of habitat classification system. Levels 1-4 are classified
oking at the entire cross-section. In this case the water is shallow and
rbulent, and is representative of a rapid. However, the secondary
abitat (level 5) is an eddy, which is more representative of deep water
ool) habitat.
Shallow Water
Turbulent
Rapid
Eddy

Percent habitat use vs. availability. C = chinook use; H = habitat availability. Numbers in the top bars of each figure represent chinook abundance, lower numbers in top figure represent discharge during the survey.

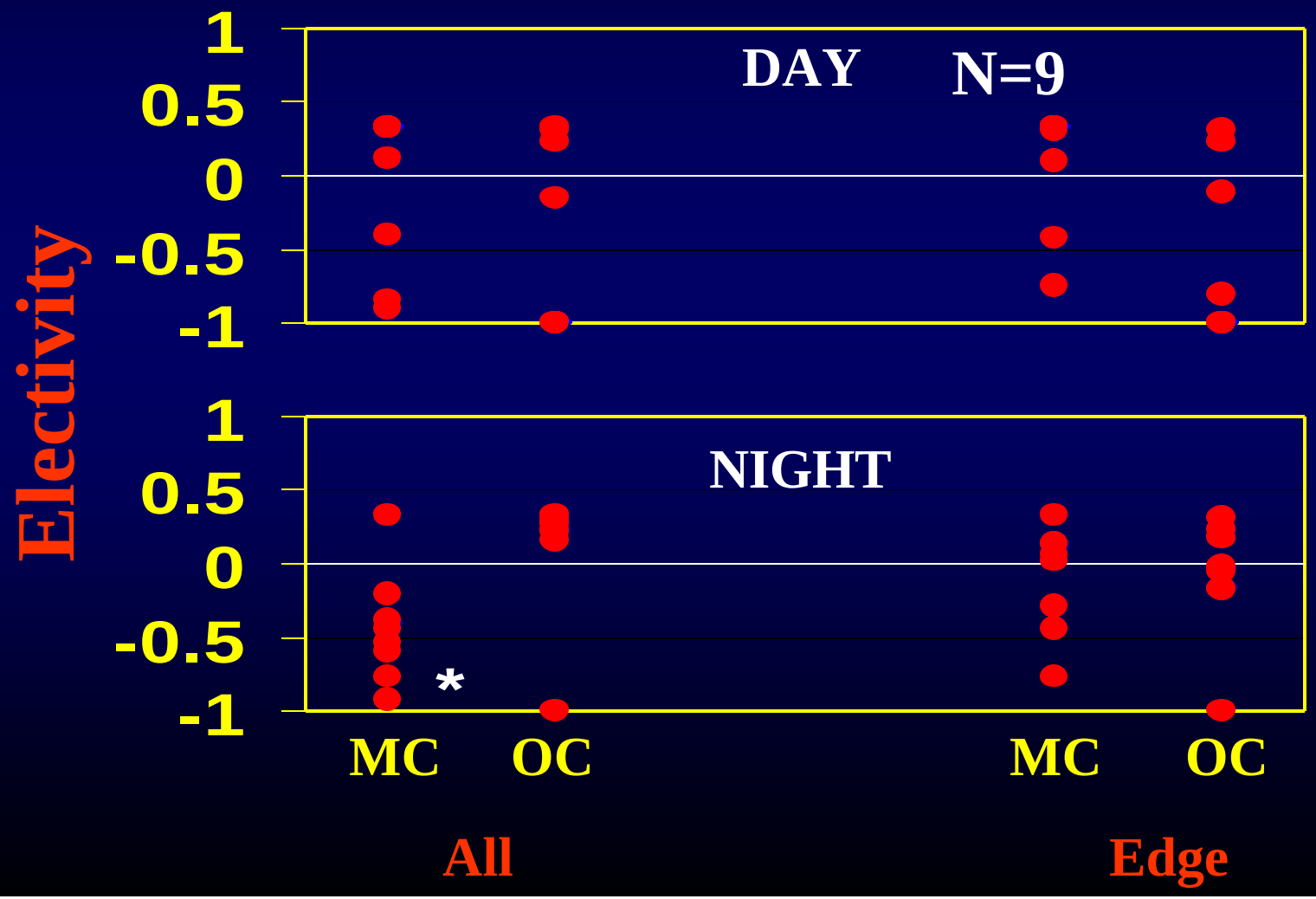


Seasonal electivity of off-channel habitat at the Elliott and 201st reaches. These were the reaches sampled once each month.

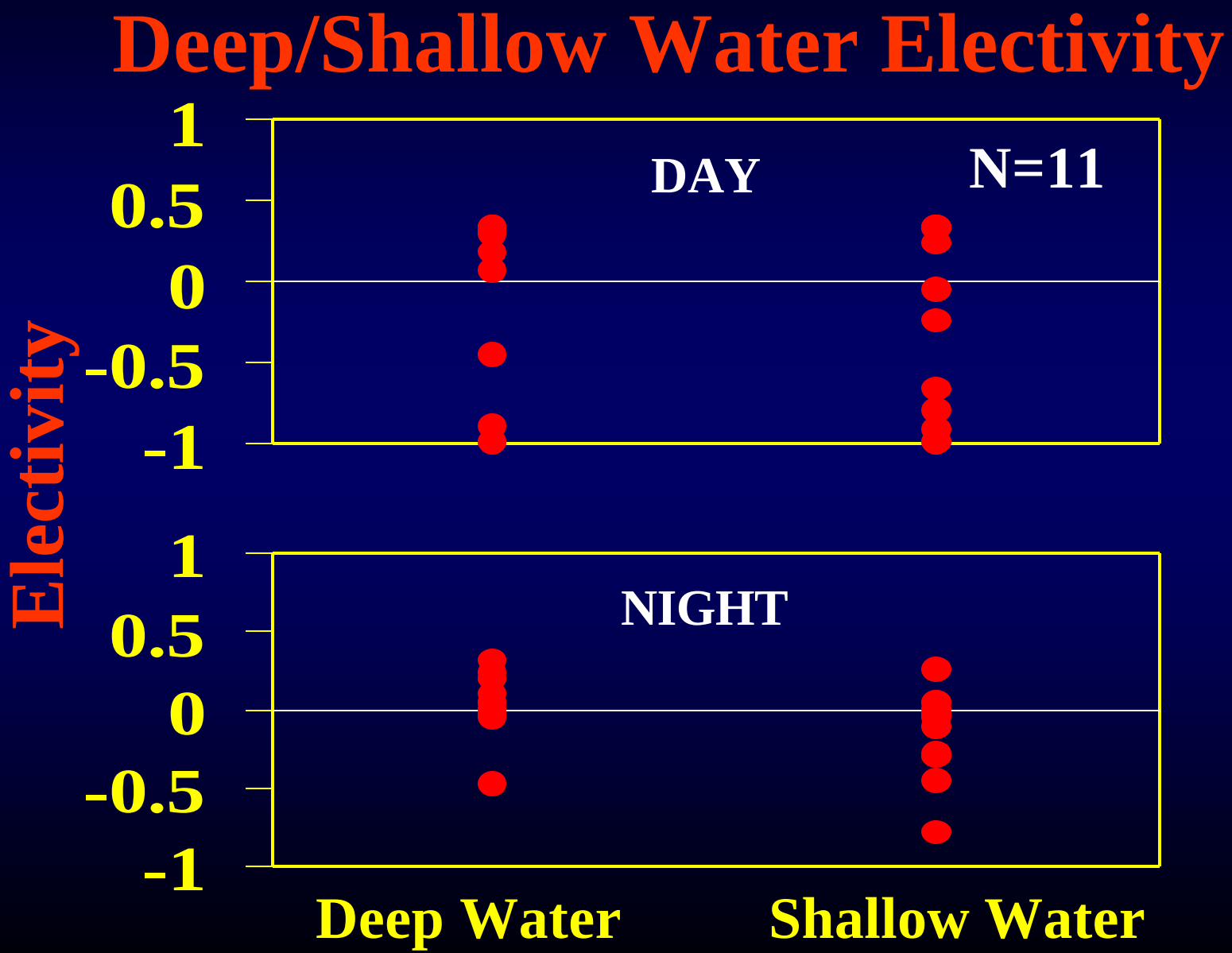


Electivity of main and off-channel habitat during day and night. All main channel habitat is included in the two columns to the left marked "All". Only main channel edge habitat was included in the two columns to the right marked edge. * = significantly different

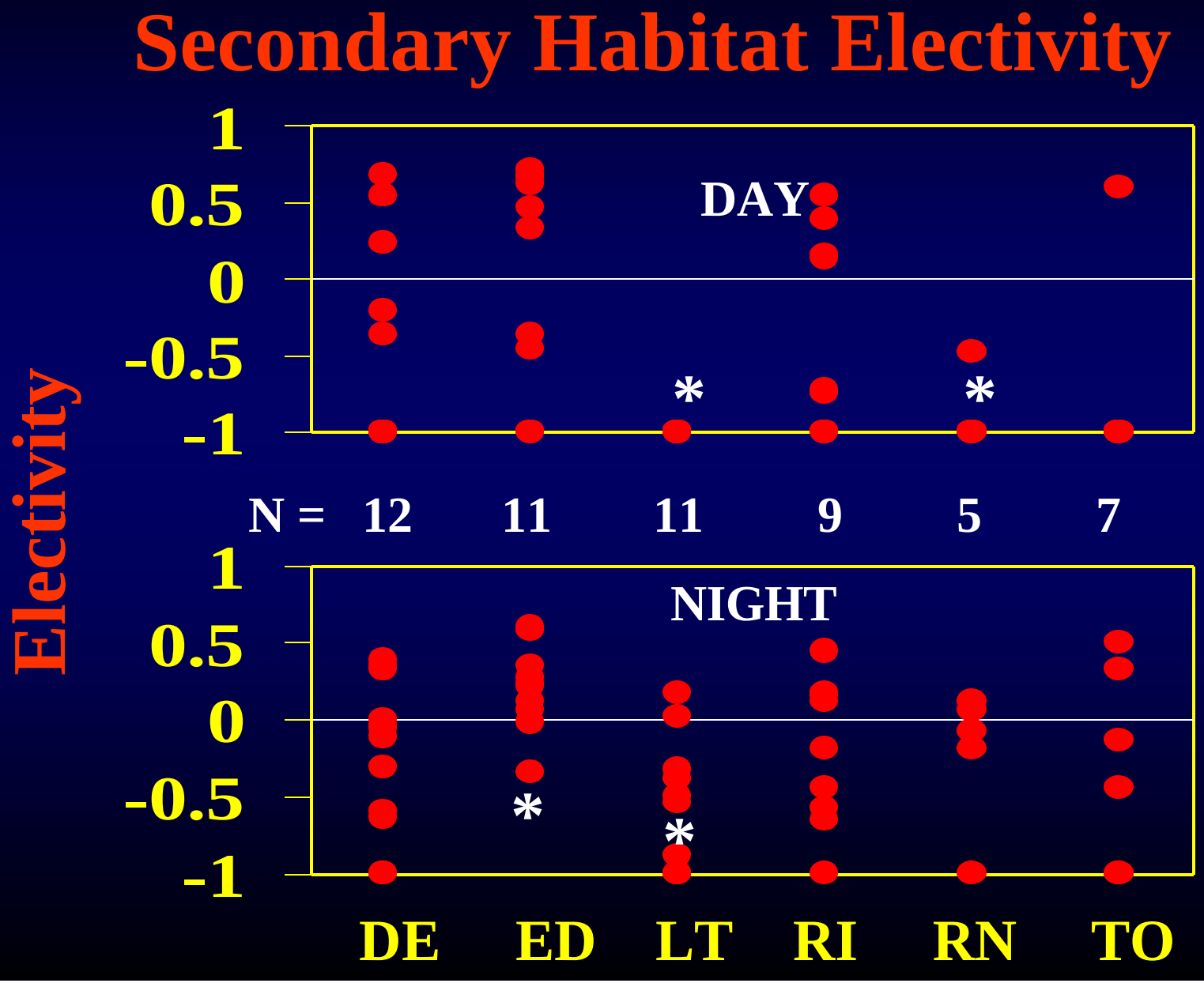
Main Channel/Off-Channel Electivity



Electivity of deep and shallow water habitats



Electivity of level 5 habitats. DE = deposition, ED=eddy, LT= Lateral Scour, RI=riffle, RN= run, TO=tailout. * = Significantly different.



Summary

- Chinook used off channel habitats extensively
- Juvenile Chinook prefer off-channel areas?
  - When all main channel habitat considered
  - Not when only main channel edge habitat considered
- No consistent seasonal changes in habitat selection

Summary

- No preference for deep or shallow water
- Showed preferences for level 5 (secondary) habitats
  - Prefer eddies at night
  - Avoid lateral scour pools day and night

What's Next?

- Examine the influence of habitat variables on juvenile chinook salmon distribution and abundance
- Examine the influence of reach level habitat characteristics on juvenile chinook salmon rearing densities